

THE WEATHER AND CIRCULATION OF NOVEMBER 1968

Continued Blocking Over Eastern North America

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1. MONTHLY MEAN CIRCULATION

Blocking weakened considerably over and near North America during November and strengthened in the eastern portion of the Northern Hemisphere.

Figure 1 shows changes in the mean 700-mb height anomaly from October to November 1968. Heights were generally lower in November from the Maritime Provinces to the Beaufort Sea. Heights decreased most near Davis Strait where a strong ridge in October weakened about 110 m as the Icelandic Low became established near southern Greenland (fig. 2).

The ridge formerly over western Europe and the United Kingdom moved eastward and acquired a strong negative tilt from Greenland to southern Russia while height anomalies increased 160 m over northern Scandinavia. This was accompanied by marked high latitude warming, height anomaly decreases of 90 m near Spain,

and by a channel of below normal heights (fig. 3) from the central United States to the mid-Atlantic (where heights were 120 m below normal) to the eastern Mediterranean. This anomaly pattern with strong easterly flow to the north and the strong westerly flow in middle latitudes is typical of widespread blocking. Westerly flow was farther south than normal with the maximum flow more than 10 m/sec faster than normal. The negative channel reflects the average path of storms this month with a secondary track into the Mediterranean south of the blocking in Europe. This track is also clearly defined in the sea-level pressure anomaly chart (not shown) in which pressures averaged as much as 15 mb below normal for November in the mid-Atlantic and 6 mb below normal in the Mediterranean.

Amplification spread eastward from the Scandinavian segment of the block. Cold air, confined to the Arctic in October, spread southward in November over western Siberia produced the strongest vortex of the month over the Northern Hemisphere. This resulted in a maximum change of 700-mb height anomaly of about 200 m and a strong maximum mean wind speed of more than 20 m/sec west of Lake Baikal (fig. 4). Weak ridging extended from Sakhalin Island to the Arctic Circle where another portion of the block became established as a 700-mb High, more than 100 m above normal.

The remaining major vortex in the Northern Hemisphere was also related to blocking. In October the Aleutian Low, about 80 m below normal, was located in the northern Bering Sea. As blocking increased, the Low moved to the southern Bering Sea and deepened as much as 150 m near the Aleutians. A strong mean wind maximum of 24 m/sec near 40°N accompanied this deep Low. Very strong storms deepened south of the Aleutians with average sea-level pressure as much as 12 mb below normal.

This flow resulted in very little increase in the ridge along western North America where a weak ridge was located in October. Heights decreased across most of the United States as maritime Pacific air predominated with little intrusion of continental airmasses through the strong westerly flow. This is usually true during this type of blocking regime in the absence of a strong ridge in western Canada. In the central United States 700-mb heights decreased by no more than 40 m from October to November as the flow changed very little. The flow

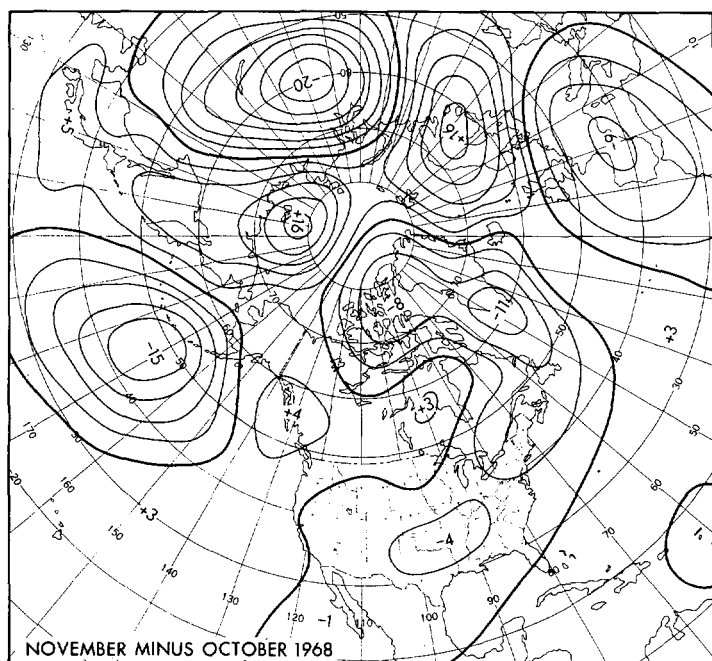
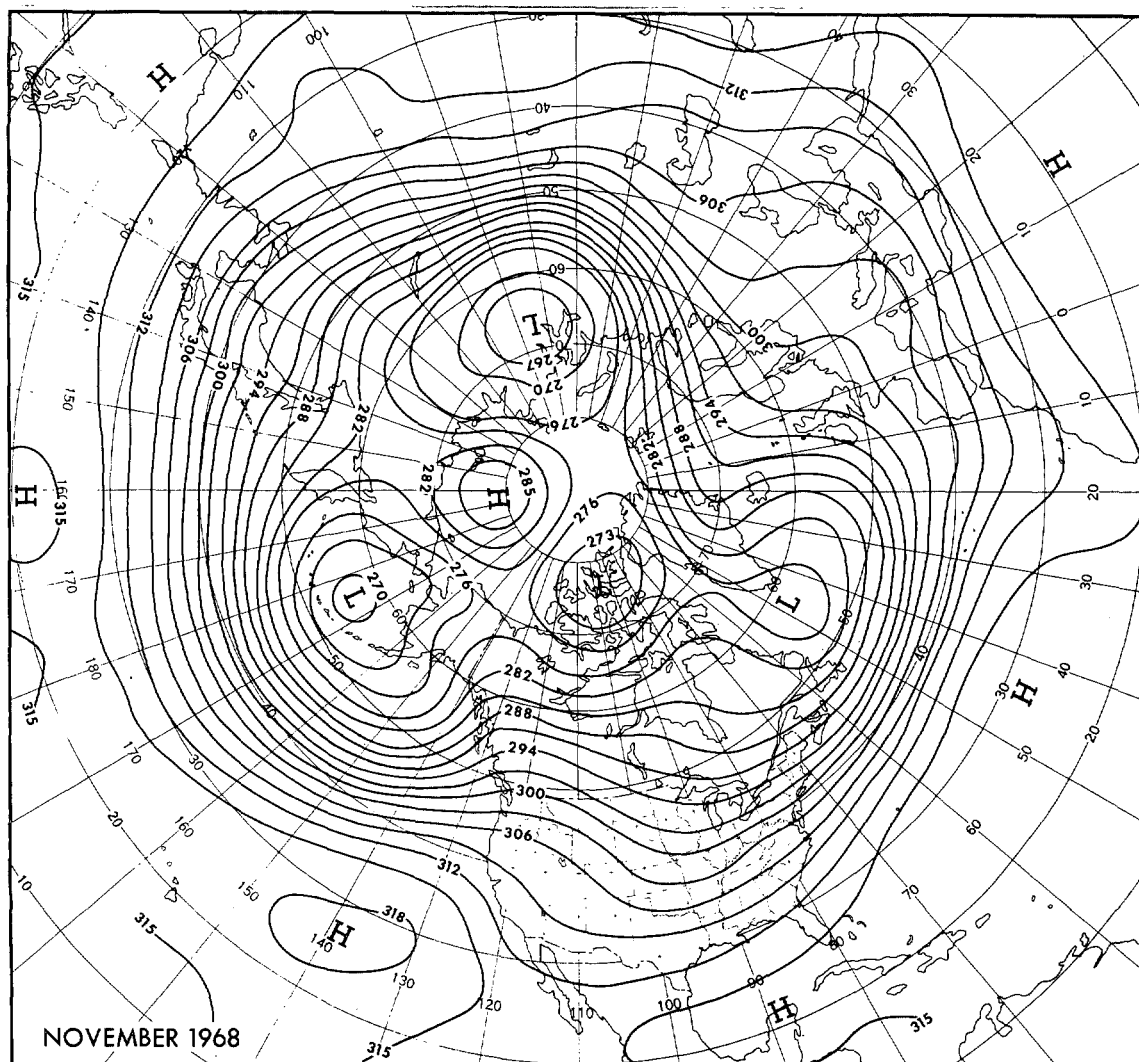


FIGURE 1.—Mean 700-mb height anomaly change (decameters) from October to November 1968.



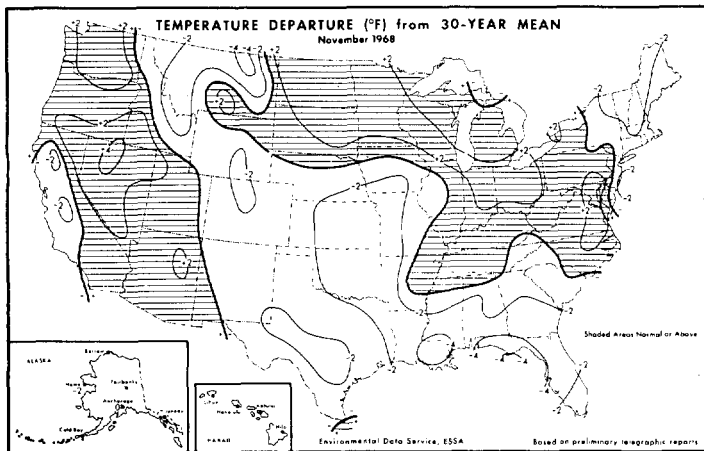


FIGURE 5.—Departure from normal of average surface temperature (°F) for November 1968 (from Environmental Data Service, 1968).

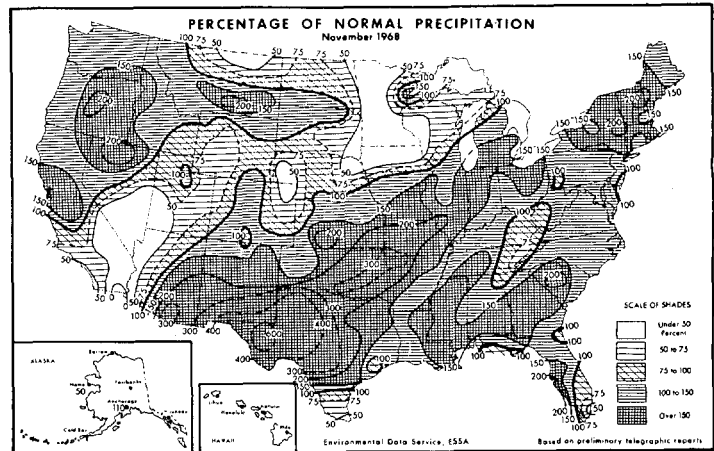


FIGURE 6.—Percentage of normal precipitation (inches) for November 1968 (from Environmental Data Service, 1968).

became more cyclonic in the eastern United States while heights increased somewhat from western Canada to lower Hudson Bay. These slight changes produced slight changes in the mean weather over the Nation.

2. MONTHLY MEAN WEATHER

Anomalous temperatures this month (fig. 5) were not well related to the anomalous 700-mb heights. Over most of the Nation, heights were below normal even where temperatures were above normal; in California where temperatures were below normal, heights were slightly above normal. Temperatures that were a few degrees below normal in New England and in central and southern portions of the Nation seemed to fit the flow very well. In these areas temperature changes from October to November were greatest and showed cooling of one or two classes. Cooling in New England amounted to two or three classes where temperatures had been above normal the previous 2 mo. Greatest warming occurred in the Ohio Valley and in the Pacific Northwest where mean temperature anomalies increased 3°–6°F this month. Except for a few daily records, no monthly records for warmth were established. Tallahassee and West Palm Beach, Fla., reported the lowest November mean temperatures of record, 54.8° and 67.8°F respectively.

Many stations in the eastern half of the Nation reported much cloudiness or low percentage of possible sunshine under the broadly cyclonic 700-mb mean flow. At Nantucket, Mass., possible sunshine was a record November low of 25 percent, and its temperature was less than a degree below normal. At Indianapolis, Ind., and Reading, Pa., possible sunshine was a record low for any month and for November, respectively, and temperatures were above normal.

Above normal precipitation fell from the Southwest to New England and over most of the Southeast (fig. 6). This was a response to the broad mean trough and cyclonic curvature that covered the eastern two-thirds of the

TABLE 1.—Unusual snowfall in November 1968

City	Amount (in.)	Dates	Remarks
Albany, N.Y.	13.5	12, 13	10 in. above November normal
Lynchburg, Va.	11.6	9, 10, 11, 12	November record
Raleigh, N.C.	1.2	12	November record
Allentown, Pa.	6.4	11, 12	Heaviest so early in the season
Greensboro, N.C.	5.9	9, 10, 11, 12	Heaviest so early in the season
Columbia, S.C.	T	11	Earliest in 45 yr

Nation. The band of precipitation that was two to six times normal from the Southwest to Illinois was along the mean track of five Lows that originated in the Southwest. Two other Lows, one from the Southwest and one from the Gulf of Mexico, were responsible for the heavy precipitation in the South, Southeast, and New England. Despite the severity of the latter two storms and the high frequency of the others, few precipitation records were established and those were for snowfall (table 1).

3. WEEKLY WEATHER RELATED TO CIRCULATION CHANGES

NOVEMBER 4–10

Blocking was strongest the first week of November (fig. 7A) as 700-mb heights in the ridge across Canada were more than 140 m above normal near northern Hudson Bay. The ridge in western North America was slightly above normal but its connection to the block helped keep heights below normal over most of the United States.

Temperatures this week (fig. 7B) were 3°–6°F above normal over the West Coast States and the Great Basin. Elsewhere, temperatures were lower than normal with maximum departures of 3°–6°F from the Northern Plains States to more than 9°F below normal on the Gulf Coast; temperatures fell below zero in Wyoming and Iowa. The freezing line reached the northern Gulf Coast States as a cold ridge extended from Hudson Bay to the Southern Plains States most of the week.

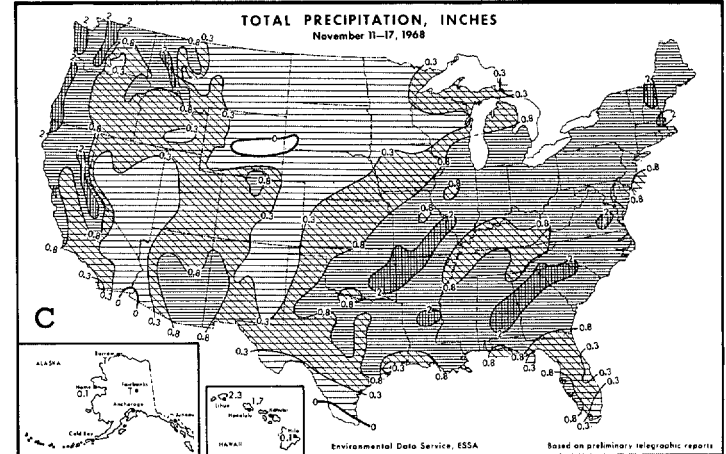
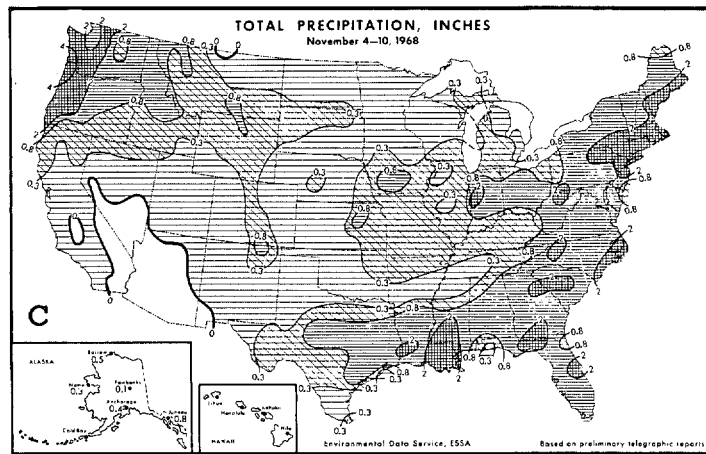
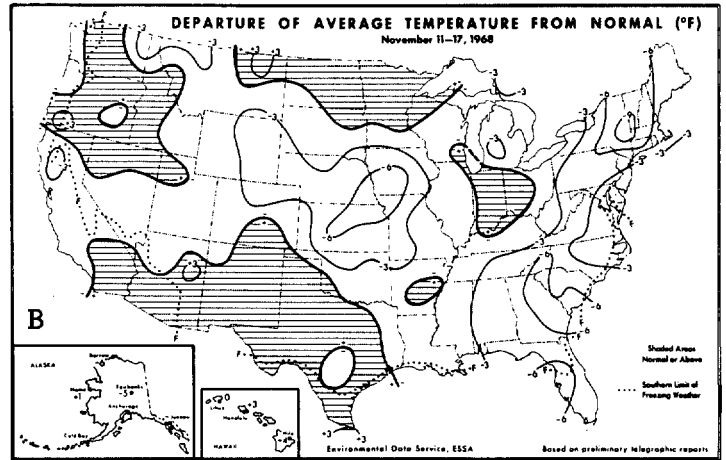
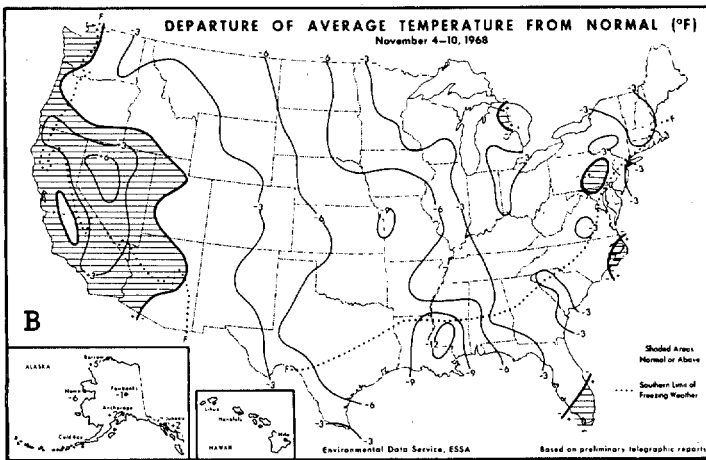
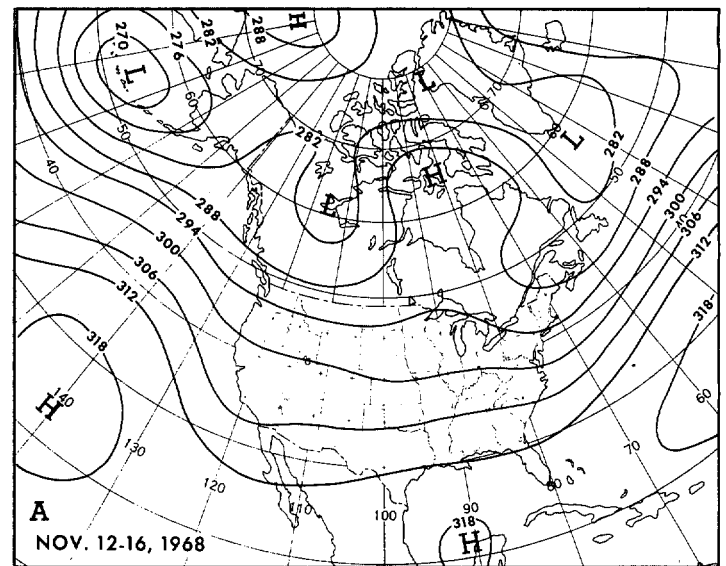
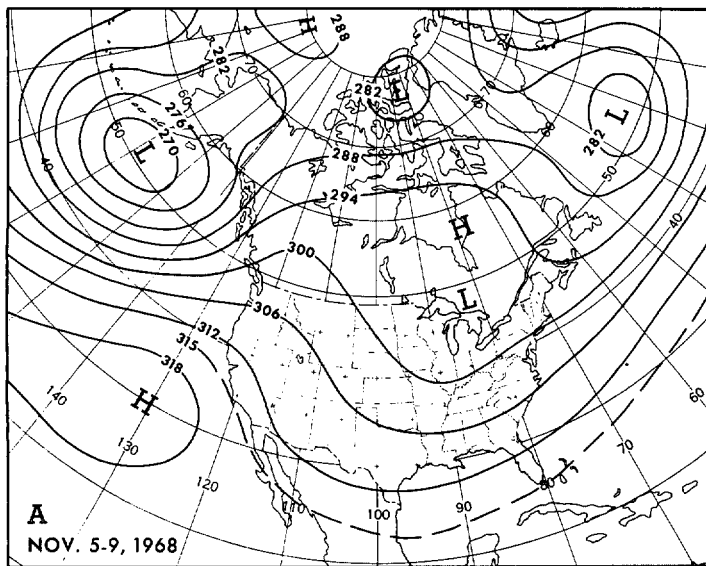


FIGURE 7.—(A) Mean 700-mb contours (decimeters) for Nov. 5-9, 1968; (B) departure from normal of average surface temperature (°F) for Nov. 4-10, 1968 (from Environmental Data Service, 1968); (C) total precipitation (inches) for Nov. 4-10, 1968 (from Environmental Data Service, 1968).

FIGURE 8.—Same as figure 7 except (A) for Nov. 12-16, 1968; (B) and (C) for Nov. 11-17, 1968.

Precipitation was rather heavy this week (fig. 7C) except in the Southwest and Midwest. Early in the week a Pacific storm spread rain in the Far West; as it moved eastward snow fell from the Rockies through the Lakes

to New England. Near the end of the week a storm formed in the Gulf of Mexico as a strong short wave moved through the mean ridge and into the Southwest. The surface Low deepened as it moved along the east coast where it was accompanied by widespread rain, with some

snow in the Northeast. Strong winds caused some damage along the coast.

NOVEMBER 11-17

The mean 700-mb flow this week (fig. 8A) ridged strongly in the eastern Pacific, and two sharp daily troughs moved into the West and changed the mean curvature from anticyclonic to cyclonic. The longwave spacing of last week from the Gulf of Mexico to the eastern Atlantic was shortened somewhat as the trough deepened off the east coast and pronounced ridging occurred in the mid-Atlantic. Blocking over Canada persisted and storminess continued along the east coast.

Cool air moved into the Far West (fig. 8B) with two major upper level daily troughs, but temperatures remained within a degree or two of normal. Along the east coast temperatures lowered somewhat this week and averaged 3°–6°F below normal. Elsewhere, marked warming predominated except for little change in the cool conditions of the week before in the Central Plains.

Two days after the vigorous storm of last week another wave developed over the Gulf of Mexico. This storm followed a track a few degrees west of the first storm and deepened rapidly near Virginia capes. Damaging winds with gusts near hurricane force and rain of an inch or more near the coast (fig. 8C) accompanied this storm. Up to a foot of snow fell in the Appalachians from the Carolinas to New England.

Precipitation in the West came from two storms, one early in the week and one late. The first storm regenerated over the Southwest as the northern portion of the upper trough sheared and moved eastward. The lower portion brought snow to the southern Rockies and as it moved eastward caused severe weather and heavy rain in the Great Plains. The principal effect of the second storm was to bring less than an inch of rain to California.

NOVEMBER 18-24

Westerly flow increased in the western portion of the Northern Hemisphere (fig. 9A) while the zonal index (35°–55°N) changed to 13.7 m/sec, 3.1 m/sec above normal and 3.9 m/sec stronger than the previous week. Amplitude decreased as westerlies strengthened in the Pacific and as blocking left North America. The ridge that was in the eastern Pacific moved into western North America and a trough replaced it. Midtropospheric heights increased by 60 m in the Great Plains and by more than 200 m over the Great Basin. Only in the eastern one-third of the Nation did heights decrease as a deep trough developed from Davis Strait to the Gulf of Mexico.

Mildness spread across the Nation (fig. 9B) as strong westerly flow prevailed by midweek. The Southeast remained colder than normal for the week with temperatures below freezing along portions of the Gulf Coast. Daily temperatures were 12°–15°F below normal from southern Florida to West Virginia with a –20°F anomaly reported at Tampa, Fla.

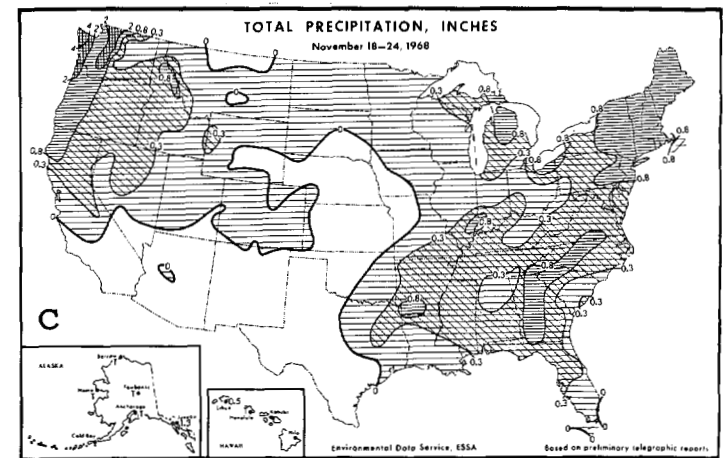
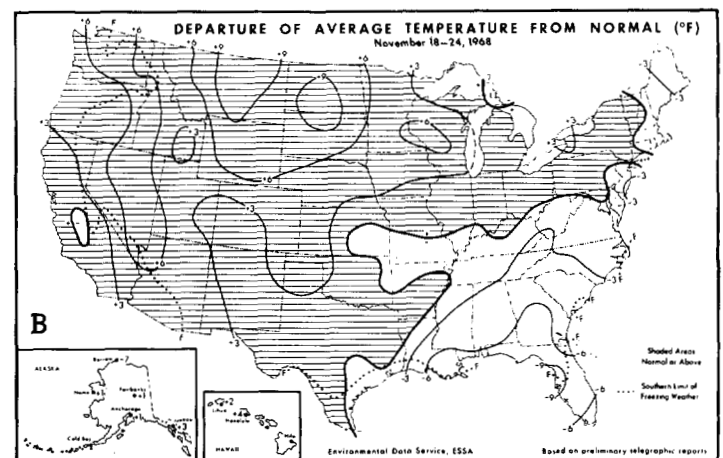
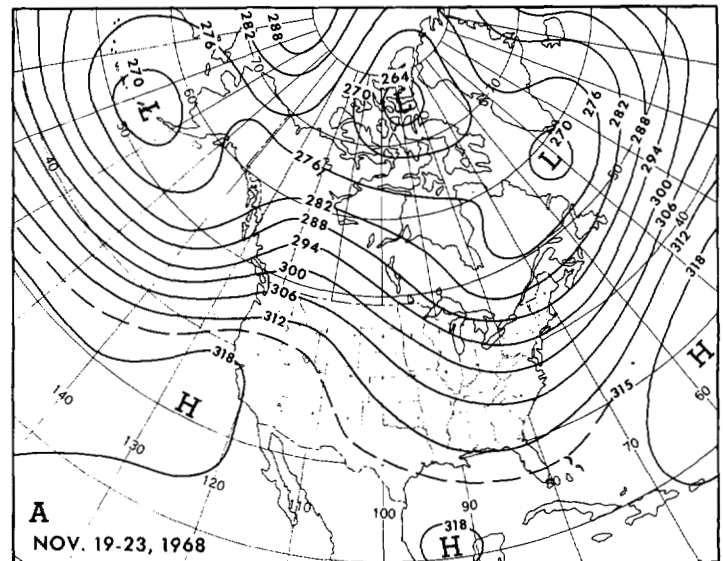


FIGURE 9.—Same as figure 7 except (A) for Nov. 19-23, 1968; (B) and (C) for Nov. 18-24, 1968.

Precipitation was generally lighter this week (fig. 9C) with totals of more than 1 in. confined to parts of Washington and Oregon as three Pacific fronts crossed this area. Quite dry conditions prevailed from the Plateau to the Great Plains because of recurrent westerly daily flow and northwesterly mean flow. In the eastern one-

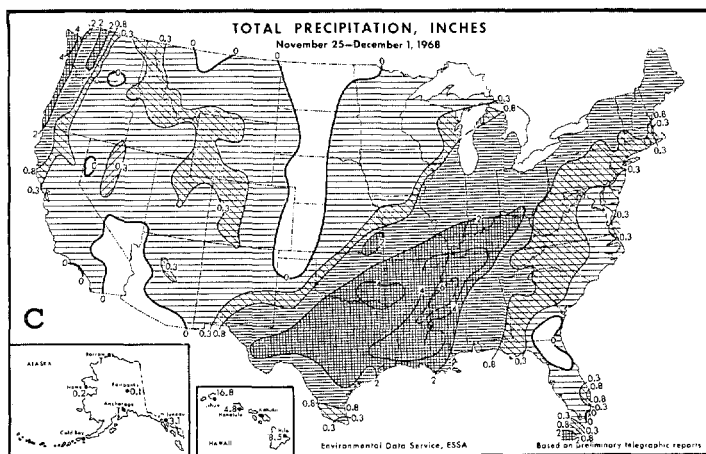
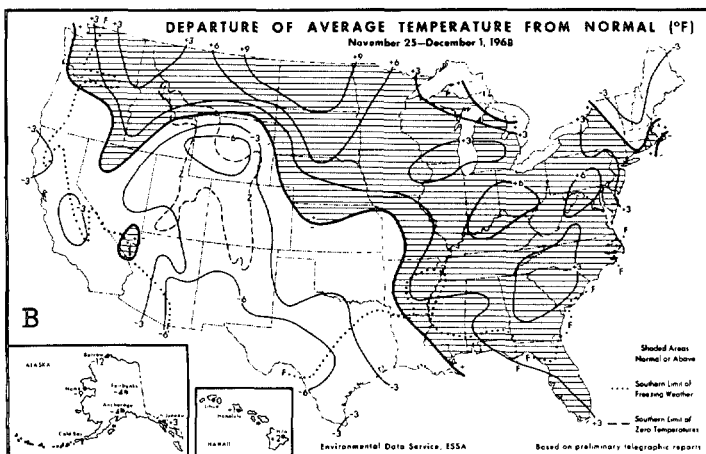
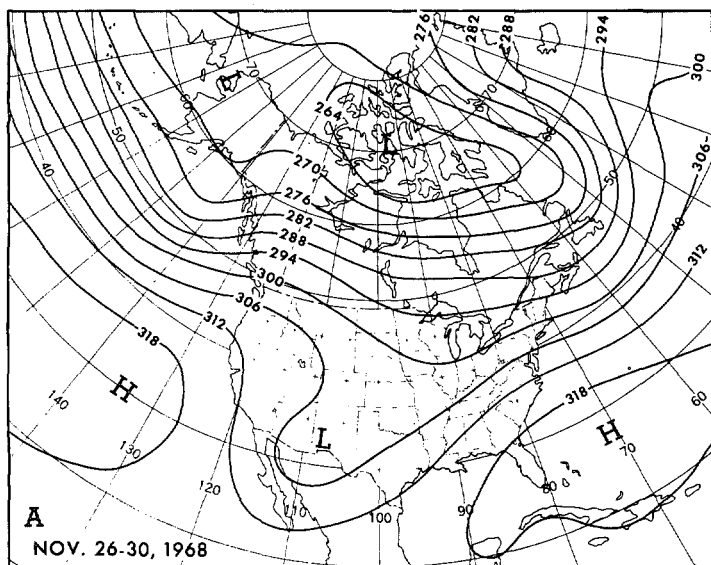


FIGURE 10.—Same as figure 7 except (A) for Nov. 26-30, 1968; (B) and (C) for Nov. 25-Dec. 1, 1968.

third of the United States precipitation was widespread but generally less than 1 in. Snow flurries were prevalent early in the week from the Dakotas to New England and along the Appalachians, but amounts were not significantly greater than normal.

NOVEMBER 25-DECEMBER 1

The fast 700-mb mean flow (fig. 10A) seemed stronger than last week, yet the midlatitude index declined slightly. The reason for this was the formation of a new trough over the Southwest and Mexico as the principal trough moved off the east coast of North America and increased the half wavelength from the western ridge to the trough in the western Atlantic. This created a strong confluence zone between the southwesterly flow from the new trough and the northwesterly flow from the western ridge.

Cooling accompanied the new trough from the Southern Plains to the central Rockies to the west coast (fig. 10B). Temperatures averaged 3°-6°F below normal through the southern Rocky Mountains and west Texas to Wyoming. Lowest daily temperature was 33°F at Frazer, Colo. Zero or lower temperatures were confined to the Rocky Mountains. The rest of the Nation was warmer than normal with little change in the northern sections but with increases of 6°-12°F in the Southeast as ridging and southwesterly flow prevailed.

Heavy precipitation fell from Texas to the lower Ohio Valley (fig. 10C) with 4 to 6 in. in the lower Mississippi Valley. Most of this fell as rain with a deepening storm that came out of the mean upper trough over the Southwest. The sea level-Low then sped through the central Mississippi Valley to the Northeast. Some snow fell near the Great Lakes but largest amounts fell in Texas (7 in. at El Paso) and New Mexico. A second upper level perturbation was forced out of the Southwest trough; associated with it, the sea-level storm spread moderate rain along the central Gulf Coast and lower Mississippi Valley the last 2 days of the week.

REFERENCES

- Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin*, Vol. 55, Nos. 46-50, Nov. 11, 18, 25 and Dec. 2, 9, 1968, pp. 1-8.